

- read about the latest developments in photographic motion studies conducted for science, industry, medicine, athletics, and art.
- review identifying main ideas vs. supporting details.
- increase your understanding of the target academic words for this unit.

Self-Assessment

TARGET WORDS

abstract

abstract

appreciat

 appreciate

 available

 display

 drama

 encounter

 expose

hence

 image

 restore

sequence

 series

transit

version

 visible

never seen
the word
before

seen the word
but am not sure
what it means

seen the word
and understand
what it means

used the word,
but am not sure
if correctly

used the word
confidently in
either speaking
or writing

used the word
confidently in
both speaking
and writing

Before You Read

Read these questions. Discuss your answers in a small group.

1. How do you assess your own performance in sports, or another physical activity (dance, aerobics, etc.)?
2. Do you like the slow-motion replays of important moments in a sports program? Why or why not? What is the point of them?
3. Have you ever seen video of your performance? If so, was it helpful? How? If not, do you think it would be helpful? How?

Read

The first selection was adapted from the "Collision Detection" column of the online magazine *Slate*. The second selection was adapted from press releases by BBC Sport and the websites of Dartfish and its American partner, Sportvision.

THE DARTFISH OLYMPICS



StroMotion™ shows frame by frame action.

POSTED BY: CLIVE THOMPSON,
AUGUST 24, 10:55 A.M.

If you've watched the most recent summer and winter Olympics, you've probably seen StroMotion™—the photo software that breaks an athlete's fluid movements into stop-motion-style freeze-frames. This fascinating software is made by the Swiss company Dartfish, and apparently Olympians have been using it to train in an incredibly innovative way. They use film footage of the performance of a past Olympic athlete and **display** it alongside footage of themselves. Both **sequences** are broken down into StroMotion™ frames.

As the Associated Press reports, pole vault star Toby Stevenson used Dartfish to virtually "compete against" a video of Sergey Bubka, the world record holder.

"I used it until smoke came out of the machine. It's great," said Stevenson, who won the silver medal in the 2004 Olympic men's pole vaulting event. Stevenson could review his practice jumps on a laptop within seconds. Within two hours of a track meet, he was able to watch himself on an LCD projector back at the hotel. Or he had his day's work burned onto a CD.

While Stevenson's muscles told him one thing, the digital video might **display** something else.

"It was a big reason for my success," Stevenson said. "I made a jump, and between every jump I watched my jump, and after practice I watched every jump on Dartfish."

This reminds me of the idea of the "ghost" competition in many popular video games. I first **encountered** it in the original Mario Kart back in 1996: You could race around a track and then do it again, competing against a recorded, "ghost," **version** of yourself. Competing against your ghost—or that of a world-ranked competitor—is now a pretty common thing in many games. It reminds me of how game innovations have constantly pioneered techniques that are transforming how we view, and play, real-world sports.

There is some debate about whether this is a good thing. Some famous judges—such as Cynthia Potter, a well-known diving analyst—wonder whether StroMotion™ is harming the sport. When judges use it, it might encourage them to give demerits¹ for things they normally wouldn't see.

"With the naked eye, you don't see these tiny little things that might be called deductions," says Potter, as divers lined up for midday practice plunges² at an Olympic venue. "I don't know if you'd even need judges if you could program all this into a computer."

But, she continues, "Human judges allow for artistic judgment—and allow divers to put personality in their dives."

Of course, this isn't an entirely new thing. The photo finish has been around for decades in many sports—and has caused huge controversies in everything from the 100-meter dash to car racing. Modern media are likely to make things even stranger. I can easily envision the next few Olympics, since Dartfish has released a program for use on mobile devices. I imagine fans getting personalized StroMotion™ streams sent to their mobile phones, which they can view and then vote on which athlete did the best dive.

BBC SPORT USES STROMOTION™ TECHNIQUE

BBC Sport is a leader in sports broadcasting innovation and was the first network in British television to use the StroMotion™ technique.

StroMotion™ is an **image** enhancement technique. It creates stunning video footage **displaying** the evolution of an athlete's movement, technique, execution, and tactics over space and time.



Sports competition and viewing is being changed by StroMotion™.

¹ demerits: points against something that is being judged

² plunges: sudden, forceful falls or dives into something

³ trajectory: the path of something in motion

Television sports viewers are able to see an athletic movement, such as the line of a skier, unfold before their eyes by compounding video **images** into a frame-by-frame **sequence**. The StroMotion™ concept is based on stroboscoping, a means to analyze rapid movement so that a moving object is perceived as a **series** of static **images** along the object's trajectory.³

StroMotion™ special effects add particular value to winter sports. For example, the StroMotion™ technique applied to an ice skater during a jump allows us to clearly see the technique and quality of its execution by highlighting the maneuver—the preparation phase, the elevation progression, the inclination and straightness of the body, and the quality and speed of execution.

Applied to the half-pipe⁴ events in gravity-extreme sports such as snowboarding, skateboarding, and skiing, StroMotion™ allows viewers to fully
30 **appreciate** the technique and the quality of aerial maneuvers (spontaneity,⁵ elevation, landing) and highlights the different phases and their **transitions**.

The StroMotion™ technology is worldwide patent-
35 protected and is exclusively **available** from Dartfish products and services. Among these products is another unique patented video application called SimulCam™.

With SimulCam™, whenever two athletes are
40 competing at different times but over the same terrain (skiers, for example), their filmed performances can be combined into a single

video. This video shows both competitors appearing to compete together. SimulCam™
45 pictures show the relative position, speed, and posture of the two competitors at each instant in a single **display**, allowing for a direct side-by-side comparison of athletic performances. SimulCam™'s value for
50 professional commentary at televised athletic events is much **appreciated** by experts, especially for purposes of comparing performance styles and visualizing time differences. It illustrates what one tenth of a
55 second's difference can mean in competition. This technology is used in a variety of sports, but it is particularly **dramatic** to watch during the Olympics. There, tiny flaws made **visible** can keep a competitor off the medal stand.

⁴ half-pipe: a U-shaped, high-sided ramp

⁵ spontaneity: unplanned action arising from a momentary impulse

Reading Comprehension

Mark each sentence as *T* (true) or *F* (false) according to the information in Reading 1. Correct each false statement on the line below it.

- 1. Using StroMotion™ and SimulCam™, it's possible for an Olympic athlete to observe his or her technique and compare it with that of a champion from the past.

- 2. The Olympic athlete Toby Stevenson sometimes feels he has made a good jump, but the StroMotion™ doesn't always confirm this.

- 3. Some diving analysts don't like StroMotion™ replays because they don't take into account a diver's creativity and artistry.

- 4. StroMotion™ is the first photographic technique to cause controversy in sports.

- 5. Clive Thompson predicts that the viewers themselves might soon be voting on Olympic dives after watching them on their cell phones.

- 6. StroMotion™ would probably be useful in viewing any sport that involves jumping.

- 7. StroMotion™ is of no value in viewing summer sports.

- 8. Many different companies sell StroMotion™ technology.

- 9. The images made visible by SimulCam™ technology help viewers appreciate tiny differences in athletic style and performance time.
- 10. SimulCam™ provides useful displays in various sports but adds little to our appreciation of the Olympics.

READING SKILL

Summarizing a Text Using Nontext Elements

LEARN

The task of summarizing a text can be broken down into two steps:

- Figure out the central ideas of a selection.
- Combine them briefly and clearly.

Also be sure to include the nontext elements—such as pictures, tables, charts, and graphs—in your summary.

APPLY

1. Identify two main ideas in *The Dartfish Olympics*.

2. Identify two main ideas in *BBC Sport Uses StroMotion™ Technique*.

3. Look at the photos that accompany Reading 1. How do they link to the main ideas? Consider the photos on their own. What main idea do they present?

4. Combine the main ideas from 1, 2, and 3 above into a summary of Reading 1. One or two sentences should be enough.

Vocabulary Activities STEP 1: Word Level

- A. Put each word in the box in the correct column, based on which target word it is a synonym for. Use your dictionary to check the meanings of new words.

accessible
advertised
exhibit

obtainable
show

treasure
understand

usable
value

available

display

appreciate

Word Form Chart

Noun	Verb	Adjective	Adverb
appreciation	appreciate	appreciative appreciated unappreciated	appreciatively

Appreciate, as a transitive verb, takes an object and means:

to value The ex-prisoners **appreciated** their freedom.

to be thankful for We really **appreciated** his help.

to understand the significance of something I can **appreciate** why this is such a big problem for you.

Note: As an intransitive verb, *appreciate* does not take an object and means "to increase in value over time." It is a very common word in business and art. The opposite is *depreciate*.

The property they bought last year has already **appreciated** 25 percent.

The value of a new car **depreciates** as soon as you buy it.

CORPUS

- B. Complete the sentences with the correct form of *appreciate* from the chart above.

- Her favorite courses in high school were in art and music _____.
- My friend was very _____ when we gave him a going-away party.
- His art collection _____ greatly over a period of 40 years.
- Their gift to us was very thoughtful and much _____.
- Because they are so rare, the old coins have _____ in value.

C. Which of these things do you value most? Rank them from 1 (most appreciated) to 6 (least appreciated). Discuss your choices with a partner.

- | | |
|--------------------------|----------------------|
| ___ your mother's advice | ___ your cell phone |
| ___ quiet neighbors | ___ air conditioning |
| ___ mass transit | ___ privacy |

D. Which of these things does an adult appreciate better than a child? Write A for things adults appreciate, C for things children better appreciate, or B for things both groups can appreciate equally. Discuss your choices with a partner.

- | | |
|------------------------------|-------------------------------|
| ___ the value of sleep | ___ the taste of chocolate |
| ___ the importance of family | ___ a surprise birthday party |
| ___ a good joke | ___ kindness |

Vocabulary Activities STEP II: Sentence Level

An *image* has both concrete and abstract meanings, but they all connect to the idea of a picture of something.

The **images** on the screen reminded him of the town where he grew up.

The **image** of the building was beautifully reflected in the lake.

Many people have the **image** of Canada as being cold all the time.

Ads try to create a positive **image** of a product.

The verb *imagine* and the noun *imagination* also come from the word *image*.

There are many expressions and collocations that feature the word *image*.

She is the very image of her sister. (She looks exactly like her sister.)

He is the very image of sophistication. (He has all the qualities of sophistication.)

She is the spitting image of her father. (She looks and acts like her father.)

E. Match each use of the word *image* with the field to which it typically belongs. Then, write an example sentence for each context. Discuss your sentences in a small group.

- | | |
|---------------------------|--|
| ___ 1. art | a. the public personality or character presented by a person |
| ___ 2. psychology | b. a symbol or metaphor that represents something else |
| ___ 3. business/marketing | c. a duplication of the visual form of a person or object |
| ___ 4. literature | d. an advertising concept conveyed to the public |

Psychology: As role models for young people, pop stars should maintain a healthy, responsible image.

- F.** The word *version* is very common in the software and publishing industries. Complete the example sentences with the correct term from the box. Then write a new example sentence for each term. Use your dictionary as necessary. Be prepared to read aloud or discuss your new sentences in class.

- | | | |
|-----------------------|---------------------|---------------------|
| a. electronic version | c. original version | e. standard version |
| b. latest version | d. revised version | f. updated version |

1. For a home computer, the e of the program is usually good enough.
The standard version of this program has all the basic tools a student needs.
2. Some of the information in this manual is old. They need to put out an _____ .

3. I found some earlier drafts of the proposal, but I need to see the _____ of it.

4. There were some mistakes in the book, but they were all corrected in the _____

5. You can buy a newspaper at the coffee shop or read the _____ online.

6. The remake of that movie was okay, but I prefer the _____ .

- G.** Discuss these questions in a small group.

1. Are you the spitting image of someone in your family? Who? In what ways are you like each other?
2. Do you know someone who is the spitting image of someone else? Who?
3. Who or what would you describe as
the very image of success
the very image of beauty
the very image of elegance
the very image of evil
the very image of power
the very image of fun

- H.** Choose one item from question 3 in activity G and in your notebook write a paragraph about your choice. Be prepared to read your paragraph aloud and discuss your opinions.

Before You Read

Read these questions. Discuss your answers in a small group.

1. When a horse gallops, do you think all four hooves ever leave the ground at the same time? Why or why not?
2. What does a splash look like? Describe a splash of water or a raindrop as it hits the ground. What happens?
3. Have you ever seen an electronic strobe light in action? Where? In what situation or for what function?

Read

This article from a popular science magazine is about the history of sequential photography.

Freeze Frames—Stopping Time



An example of Muybridge's fast-motion photography

For most people, the arc of their golf swing or tennis stroke is an **abstract image**, something that happens much too fast for the unaided eye to see. Fortunately, modern athletes have a special tool **available**—StroMotion™—with which to obtain and study an actual, **visible** record of their movements. But StroMotion™ is not a brand new concept—in fact it's an old idea newly linked to digital video and computer software. StroMotion™ uses processes and technology developed by photographic pioneers such as Eadweard Muybridge, who conducted the first photographic **sequential** motion studies, and Harold Edgerton, inventor of the strobe light, which seems to stop even the speediest objects—like bullets—in **transit**.

In 1872, Leland Stanford—the soon-to-be Governor of California who was also a businessman, horse lover, racetrack owner, and

later founder of Stanford University—**encountered** this commonly debated question of the time: whether during a horse's gallop all four hooves were ever off the ground at the same time. This was called “unsupported **transit**,” and Stanford took it upon himself to settle this popular debate scientifically. He hired a well-known British photographer named Eadweard Muybridge, then working in San Francisco, to get the answer.

By 1878, Muybridge had successfully photographed a horse in fast motion using a **series** of fifty cameras. The cameras were arranged along a track parallel to the horse's, and each of the camera shutters was triggered by electronic timers developed specifically for the project. The resulting **series** of photos proved that the hooves do all leave the ground at the same time—although not with the legs fully extended forward and back, as artists of

the day had imagined, but rather at the moment when all the hooves are tucked under the horse, as it switches from "pulling" from the front legs to "pushing" from the back legs.

45 Muybridge continued to use this technique to photograph human beings and animals in order to "freeze" and study their motion. He made sequential motion studies of athletes in a wide variety of sports and additional studies of
50 everyday people performing mundane movements like walking down stairs. Muybridge's work helped inaugurate the modern science of biomechanics, the research and analysis of the mechanics of living organisms.

55 Furthermore, when a viewer flips rapidly through a **sequence** of Muybridge's pictures, it appears to the eye that the original motion has been **restored**. Viewers **appreciated** these **images** for reasons of both science and
60 entertainment, and inventors like Thomas Edison were inspired to work harder on the creation of a motion picture process. **Hence** Muybridge is considered to have been a crucial figure in the development of movies.

65 Muybridge showed that the value of a **sequence** of photographs could be greater than that of any single **image**, a lesson that was later applied in photojournalism as well as biomechanics. But after Muybridge, inventors
70 persisted in seeking ways to photograph faster and faster motion, and eventually they came back to the stroboscope.

A stroboscope, also known as a strobe, is an instrument used to make a fast-moving object
75 appear to be slow-moving or stationary.¹ It is mainly employed in industry for the study of the motion of objects, such as rotating machine parts or vibrating strings.

The stroboscope was designed by Joseph
80 Plateau of Belgium in 1832. In its simplest form, it is a rotating disc with evenly spaced small openings cut into it. It is placed between the observer and the moving object and rotates to alternately block and reveal the object. When the
85 speed of the disc is adjusted so that it becomes synchronized² with the object's movement, the object seems to slow and stop. The illusion is commonly known as the "stroboscopic effect."

¹stationary: still, not moving

²synchronized: matching, in step with

In 1931, almost exactly one hundred years
90 after Plateau, an engineering professor at the Massachusetts Institute of Technology named Harold Edgerton combined the stroboscope and the camera. He created an electronic **version** of the strobe in which the rotating disc was
95 replaced by a special lamp. The lamp emits brief and rapid flashes of light. The frequency of the flash is adjusted so that it is a fraction of the object's speed. At this point, the object appears to be stationary.

100 Although his original goal was to **display** and study the stresses on moving machine parts otherwise **invisible** to the naked eye, Edgerton later used very short flashes of light as a means of producing **dramatic still**
105 photographs of fast-moving objects in **transit**, such as bullets in flight, hovering hummingbirds, and falling milk drops splashing into a bowl. His camera had no shutter. The film was pulled through
110 continuously as in motion picture cameras—but at much higher speeds—and **exposed** by a stroboscopic flash lasting 1/1,000,000 of a second or less.

Edgerton's invention was the basis for
115 the built-in light flash found in nearly all cameras today. Strobes are also popular as a lighting effect in nightclubs, where they create the appearance of dancing in slow motion. Other common uses are in alarm
120 systems, theatrical lighting (for example, to simulate lightning), and as high-**visibility** navigation lights.



Edgerton produced photographs of fast-moving objects in transit, such as milk drops splashing into a bowl.

In medicine, stroboscopes are used to view the vocal cords. Both the strobe and the camera are placed inside the patient's neck using a procedure called endoscopy. The patient then hums or speaks into a microphone, which in turn activates the stroboscope. Doctors can see the movement of the vocal cords and diagnose problems.

Strobe technology has also been instrumental in the development of underwater scanning technology—useful in searching the sea bottom for shipwrecks—and is valuable in photographing creatures living in the darkest depths of the ocean. Edgerton worked with the

undersea explorer Jacques Cousteau, providing him with underwater stroboscopes.

In addition to having the science, engineering, and business skills to advance strobe lighting commercially, Edgerton is equally **appreciated** for his visual flair. Many of the **dramatic images** he created for science are now found in art museums worldwide. In Edgerton's strobe work, science and art **encounter** one another and find that in some way they serve the same need for exactitude—a goal shared by the athletes who use video StroMotion™ today to improve their competitive performance. ■

Reading Comprehension

Mark each sentence as *T* (true) or *F* (false) according to the information in Reading 2. Correct each false statement on the line below it.

- ___ 1. Stanford hired Muybridge to find out whether both wings flap simultaneously when a chicken is flying, but Muybridge switched to studying horses.

- ___ 2. Muybridge failed to prove conclusively that all four of a horse's hooves do at some point leave the ground at the same time.

- ___ 3. Before Muybridge made his motion studies, painters had incorrectly portrayed a horse's gallop.

- ___ 4. Motion picture inventor Thomas Edison was aware of Muybridge's work.

- ___ 5. Edgerton's electronic strobe light and the built-in flash units in today's cameras are unrelated inventions.

- ___ 6. Creatures living in the darkest depths of the sea were made visible by Edgerton's strobes.

- ___ 7. The need for exactness is common to art, science, and athletics.

- ___ 8. Photographs can expand our world by showing us things we can't normally see.

APPLY

1. Identify two main topics in Reading 2.

2. Look at the photos that accompany Reading 2. How do they link to the main ideas? Consider the photos as a group. What main idea does the group present?

3. Combine the main ideas from the text and the accompanying images into a summary of Reading 2.

REVIEW A SKILL Identifying Main Ideas vs. Supporting Details (See p. 20)

Reread the article on pages 73–75. As you read each paragraph, think about the author's main purpose. Identify the main ideas and supporting details for each paragraph and write these in your notebook.

Vocabulary Activities STEP 1: Word Level

- A. Complete these sentences using the target vocabulary in the box.

abstract	dramatist	transition	visibility
dramatic	invisible	transitional	

1. Many believe that the best _____ in English was Shakespeare. He wrote at least 37 plays.
2. When writing an essay, it is important to use a _____ to connect the ideas in one paragraph with those in the next paragraph.
3. A painting without a story or representational image is referred to as _____ art.
4. The observation deck at the top of a tall building provides the best view of a city, but only if there is clear _____ that day.
5. The strong contrast between light and dark in black-and-white films can create quite a _____ effect.
6. Doctors can use a strobe and a powerful lens inside the body to make _____ processes viewable on a computer screen.
7. The office hasn't moved completely to the new location yet. We're still in a _____ phase.

- B.** Put each word in the box in the correct column, based on which target word it is a synonym for. Use your dictionary to check the meanings of new words.

bring back consequently renovate	reveal revive	show therefore	thus uncover
--	------------------	-------------------	-----------------

expose	hence	restore
_____	_____	_____
_____	_____	_____
_____	_____	_____

Word Form Chart			
Noun	Verb	Adjective	Adverb
series	_____	_____	_____
sequence	sequence	sequential	sequentially

The word *series* is both a singular and plural noun. When it has the meaning of “one set” it takes a singular verb. When the meaning is “two or more sets,” it takes a plural verb.

A **series** of lectures is planned for next semester. (*singular*)

Two **series** of lectures are planned for next year, one in each semester. (*plural*)

The words *series* and *sequence* are synonyms. *Series* generally refers to “a number of things that come one after another and are of the same type or connected,” as in *a series of days* or *a television series*.

A film is a **series** of images displayed at high speed.

Sequence is usually used for “a number of related actions or events that happen or come one after another,” as in *a sequence of odd numbers*. A sequence usually has an order that follows some inner logic or relationship pattern.

Film creates the illusion of movement by putting together a **sequence** of frames in which actions progress very slightly from one to the next.

- C.** Decide whether these things are or involve a series (S) or a sequence (Q). Use your dictionary to check the meanings of new words. Discuss your decisions with a partner. Think of one more series and sequence.

- | | |
|---|--|
| ___ 1. issues of a monthly magazine | ___ 4. a soap opera |
| ___ 2. events leading up to a discovery | ___ 5. Spider-Man™ comic books |
| ___ 3. operating a camera | ___ 6. driving from one place to another |

Series: _____

Sequence: _____

What is the difference between *transit* and *transition*?

Transit is usually used to refer to “the act of moving or being taken from one place to another.” Some common terms are *mass transit* and *rapid transit*, which refer to forms of transportation that carry people.

*Edgerton produced dramatic still photographs of fast-moving objects in **transit**, such as bullets in flight.*

Transition is generally used more to talk about “the process of changing from one condition or form to another.”

*StroMotion™ allows viewers to fully appreciate the technique and the quality of aerial maneuvers and highlights the different phases and their **transitions**.*

A person or thing in *transit* is moving or traveling from one place to another.

A person or thing in *transition* is changing form or nature in some way.

D. What types of transitions might these things go through? Discuss your ideas in a small group.

1. a caterpillar
2. a teenager
3. a small business
4. an ambitious worker
5. a senior citizen
6. a story someone thinks of

Vocabulary Activities STEP II: Sentence Level

Hence has two common functions. Sometimes it is a logical transition word, meaning “as a result.”

*These dolls were handmade; **hence**, they are expensive.*

It can also mean “from now” or “in the future,” though this usage is becoming somewhat formal and old-fashioned.

*Today everyone is excited about fashion trends that will be boring and out of style a year **hence**.*

E. Complete these sentences using the word *hence*.

1. He ate a lot of sweet, fatty foods and never exercised; hence,
he gained a lot of weight.
2. The team's star player was injured the day before the big game; hence,
_____.
3. When she was young she was stung by a bee; hence,
_____.
4. Both of his parents were musicians; hence,
_____.
5. $A = B$ and $B = C$; hence,
_____.

Before digital photography was invented, photographers had to allow film to be struck by light—they had to *expose* film—in order to capture an image.

After first **exposing** the film, photographers used a series of chemicals to develop the image.

More generally, *expose* means to show something or make something visible. Usually this is something hidden, concealed, or previously unknown.

The bright lights **exposed** all the cracks and lines on the wall.

Note: *Expose* and *display* are both synonyms of *show*, but *display* is generally used to talk about showing things to make them look good, possibly to sell something or attract attention. *Expose* is often used to show something shameful, corrupt, immoral, or dishonest that had been hidden or disguised.



F. In your notebook, rewrite these sentences using the cues in parentheses.

Check your dictionary for help with new words and meanings. Be prepared to read aloud or discuss your sentences in class.

- 1. The heavy rains have eroded the riverbank. Now all the roots of the trees and bushes are bare. (*expose*)
The heavy rains have washed away the riverbank and exposed the tree roots.
- 2. Before coming to the city for school, she had never had the opportunity to appreciate the arts. (*exposure*)
- 3. The businessman had to resign after the newspaper found out about his questionable financial deals and published the information. (*exposé*)
- 4. Parents sometimes allow their children to catch a contagious disease, like measles or chicken pox, so that the children will be immune to the disease as adults. (*be exposed to*)
- 5. The hikers who got lost in the mountains died because they were out in severe weather for too long. (*exposure*)
- 6. Be sure to put sunscreen on any uncovered areas so that your skin doesn't burn. (*exposed*)
- 7. At a home design show, you can get great ideas for decorating your apartment. (*exposition* or *expo*)
- 8. His clients found out he was a fraud and told the police about how he sold them nonexistent property. (*exposed as a fraud*)